Response to the Productivity Commission's Draft Report:

A Path to Universal Early Childhood Education and Care

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INTRODUCTION

Little Scientists Australia appreciates the opportunity to provide a submission to the Productivity Commission regarding its Draft Report on the Early Childhood Education and Care (ECEC) sector. This submission addresses specific findings and a recommendation in the Draft Report related to professional development.

This submission also brings attention to an issue not mentioned in the Draft Report, which is early STEM (Science, Technology, Engineering, Mathematics) education. In this submission, Little Scientists provides information about the state of early STEM education in Australia, the lack of early STEM teaching skills and knowledge in the ECEC sector, and a growing issue regarding children's equitable access to evidence-based early STEM education in Australia.

LITTLE SCIENTISTS AUSTRALIA

Little Scientists is a not-for-profit initiative funded by the Australian Government. Little Scientists' mission is to champion inquiry-based STEM education for children aged 0-7 years in Australia. We do this by training early childhood educators and early primary school teachers in early STEM teaching skills, which is an area lacking in educators' pre-service tertiary teaching qualifications.

Little Scientists is the only dedicated provider of STEM professional development to the early childhood sector in Australia. This makes our STEM workshops vital to ensuring educators have the skills and confidence to provide Australia's children with high-quality early STEM education.

COMMENTS ON THE DRAFT REPORT

Draft finding 3.7 The ECEC workfaces faces barriers to professional development.

Little Scientists welcomes the Commission's draft finding that recognise the barriers early childhood educators and teachers (henceforth referred to collectively as "educators") face to partaking in professional development. As a provider of professional development to the ECEC sector since 2013, Little Scientists is acutely aware of these barriers, which are broadly:

- Profound staff shortages.
- High costs of professional development.
- High demands of compliance training.

Profound staff shortages across the ECEC sector make it difficult for educators to take time off work to attend professional development. This is even the case when early learning services and providers (henceforth referred to collectively as "services") pay for their educators to attend professional development.

For example, Little Scientists held multiple workshops in 2023 where only 50-75% of educators with tickets pre-purchased by their service attended on the day. This equated to the service losing approximately $1,075-$1,505 in nonrefundable tickets in each instance. Little Scientists spoke to each of these services and learned that, in all instances, on the day of the workshop, educators who were rostered on to work were ill and the service was unable to find casuals to replace them because of workforce shortages. As a result, educators earmarked for professional development needed to work instead.

Another significant barrier is the high cost of professional development in comparison to the average service's professional development budget and the low wages of educators. High-quality professional development is particularly expensive because it tends to require a greater time commitment and is often held in-person. (Despite the trend towards online learning, in-person professional development is still the gold standard in terms of learning outcomes and impact.) In addition to this, professional development related to pedagogy, curriculum, and practice needs to be undertaken on an ongoing, rather than one-off, basis, which makes it more expensive still. This is particularly true of early STEM professional development.

The cost of professional development is not limited to the cost of a ticket. Additional costs can easily equate to triple the cost of a ticket. For example, **if a service is paying for an educator's professional development**, they will incur the cost of:

- The ticket.
- The cost of paying the educator to attend the workshop.
- An educator to replace this educator on the floor.

If an educator is pursuing professional development independently, then they:

- Incur the cost of a ticket.
- Forgo income they would have earnt from working these hours instead.

The high demands of undertaking compliance training — for example related to child safety, first aid, CPR, supervision, food handling, safe sleep and rest — exacerbate barriers to other types of professional development. This is because:

- There is a large range of compliance training that must be undertaken.
- Compliance training often needs to be undertaken by multiple or many educators at the one service.
- Compliance training needs to be refreshed regularly.

The consequence of this is that it leaves many services with little to no money or staff capacity remaining to engage in professional development that directly improves the quality of teaching and education at their service.

In **Figure 3.19** of the Draft Report, over 50% of professional development undertaken by paid contact ECEC staff was marked as "Other relevant training courses". In reference to this figure, the Draft Report states:

> *"It is possible that some of the responses in this category relate to mandatory training (such as training related to first aid or child protection), which – while essential – are focussed more on meeting safety requirements rather than professional development per se."*

From our vantage at Little Scientists, we would estimate that **compliance training accounts for a very significant portion** of this figure. The implications of this should be considered.

For example, it is very concerning that Figure 3.19 shows that ***less than 1 in 3 educators*** participated in any professional development to improve the quality of pedagogy or practice in the previous 12 months, especially considering the breadth of this category. The fact that so few educators participated in this type of professional development — despite it being essential to quality and up-to-date teaching and education — indicates that educators are not being sufficiently supported to prioritise this. Greater

support for pursuing this type of professional development must be addressed to improve the quality of educator's teaching and early childhood education generally.

Draft recommendation 3.6: Contribute to professional development for the ECEC workforce.

Little Scientists welcomes the draft recommendation that suggests federal and state and territory governments provide a contribution towards the cost of professional development. We also echo the importance of this support being targeted toward professional development activities that will improve the quality and inclusivity of ECEC practices. However, we feel that the recommended activities listed in the Draft Report are too broad, meaning any additional financial contribution could be further concentrated on compliance training.

While contributing towards the cost of professional development at both the service and educator level is needed, cost is just one of two primary barriers when it comes to educators participating in professional development that directly improves their early teaching skills and knowledge. The other barrier is a lack of external and explicit prioritisation of this type of professional development.

To address this, Little Scientists would recommend that services and educators receive **a specific and significant cost contribution or bursary** towards professional development that directly improves their early teaching skills and knowledge. This should be clearly communicated to encourage services and educators to prioritise this type of professional development.

WHAT'S MISSING IN THE DRAFT REPORT? EARLY STEM EDUCATION.

Little Scientists notes that the Draft Report includes only one reference to STEM (Science, Technology, Engineering, Maths). This is in **Figure 3.19**, in which STEM professional development is listed as an example of specific curriculum professional development that was undertaken by only 12% of the ECEC workforce in the previous 12 months. One can assume then that STEM professional development accounts for no more than 1% of the total.

The omission of early STEM education in the Draft Report is not surprising. There is **very low awareness of early STEM education in Australia**, with public policy yet to catch up with scientific consensus that recognises STEM education as critical to early childhood development. Indeed, a STEM Education Initiatives Synthesis Report provided to Australian Education Ministers in 2021 included just one early childhood initiative out of a total of 69 (just 1.5%)[1]. This lack of investment in and recognition of early

[1] STEM Education Initiatives Synthesis Report, Department of Education, Skills and Employment, 16 September 2021

STEM education poses a threat to the quality of early childhood education in Australia and should be addressed as soon as possible to minimise an emerging equity gap in early STEM learning.

Why is early STEM education important?

1. STEM learning improves children's wellbeing & development.

There is now scientific consensus that early childhood is the critical window to commence STEM education.[2] Research shows that children who engage in rich STEM learning from infancy develop stronger STEM identities, dispositions, and skills — like critical thinking, problem solving, and creativity — that improve their wellbeing and education outcomes generally.[3]

A growing number of studies shows a correlation between children's access to early STEM learning and success in school generally. For example:

- Early maths skills in preschool predict academic achievement in high school more consistently than early reading.[4]
- Early STEM experiences can influence subject selection and science achievement in later education, as well as the decision to pursue a STEM career.[5]
- Early STEM learning underpins and supports all areas of language development, especially oral language.[6]

2. Early childhood: the critical intervening window for girls.

Developing strong STEM identities is especially important for young girls. Without intentional early STEM learning experiences, girls start to internalise negative gender stereotypes about STEM **as early as preschool** (for example: girls aren't good at maths).[7] **By the age of six,** girls have started to de-identify with STEM[8] and implicit gender biases have negatively impacted their participation and enthusiasm for STEM learning.

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[2] McClure, E. R., Guernsey, L., Clements, D. H., Bales, S. N., Nichols, J., Kendall-Taylor, N., Levine, M. H., STEM starts early: Grounding science, technology, engineering, and math education in early childhood, New York: The Joan Ganz Cooney Center at Sesame Workshop, 2017

[3] Hadani, H. S., Rood, E., The Roots of STEM Success: Changing Early Learning Experiences to Build Lifelong Thinking Skills, The Centre for Childhood Creativity, 2018

[4] National Research Council, Mathematics Learning in Early Childhood: Paths Toward Excellence and Equity, Washington, DC: The National Academies Press, 2009

[5] Tai, R. H., Qi Liu, C., Maltese, A. V., & Fan, X., Planning early for careers in science. Science, 2006

[6] Sarama, J., Lange, A., Clements, D. H., Wolfe, C. B., The impacts of an early mathematics curriculum on emerging literacy and language, Early Childhood Research Quarterly, 2012

[7] Gunderson, E. A., Ramirez, G., Levine, S. C., Beilock, S. L., The role of parents and teachers in the development of gender related math attitudes. Sex Roles, 2012

[8] Master, A., Meltzoff, A. N., Cheryan, S., Gender stereotypes about interests start early and cause gender disparities in computer science and engineering, University of Houston, 22 November 2021

Negative STEM dispositions become harder (and more expensive) to shift as children grow older, with interventions to increase girls' participation in STEM in later primary and secondary school start too late. A lack of STEM inclusion in early childhood is having lifelong consequences, with women holding just 15% of all STEM-qualified jobs in Australia.[9]

Girls are impacted by parent and educator attitudes towards STEM.

In the home environment, parents are far more likely to engage in informal science and maths activities, like counting, with boys compared to girls.[10] Studies show that both fathers and mothers believe that maths is more important for boys and regard boys as more gifted in STEM.[11] Mothers play a critical role in influencing their daughters' attitude towards STEM; however, many mothers — particularly from low-income families — have internalised traditional gendered stereotypes and experience self-doubt around their ability to support STEM learning at home.[12] [13]

Similarly, educators perceive boys as more confident than girls in all STEM subjects according to the STEM Equity Monitor.[14] While educators who are confident and enthusiastic about STEM pass this excitement onto children, there is widespread anxiety and negative self-perception amongst early childhood educators about teaching STEM. This correlates with lower self-confidence in the children they educate, especially girls.[15] This is not surprising when you consider 92% of early childhood educators are women,[16] many of whom would have faced their own barriers to accessing STEM education.

[9] The state of STEM gender equity in 2023, Department of Industry, Science, and Resources, Australian Government, 2023

[10] Hart, S. A., Ganley, C. M., Purpura, D. J, Understanding the Home Math Environment and Its Role in Predicting Parent Report of Children's Math Skills, 22 December 2016

[11] Gunderson, E. A., Ramirez, G., Levine, S. C., Beilock, S. L., The Role of parents and teachers in the development of gender related math attitudes. Sex Roles, 2012

[12] Tenenbaum, H. R., Snow, C. E., Roach, K. A., Kurland, B, Talking and reading science: Longitudinal data on sex differences in mother-child conversations in low-income families. Journal of Applied Developmental Psychology, 2005

[13] Gilligan, T., Lovett, J., McLoughlin, E., Murphy, C., Finlayson, O., Corriveau, K., McNally, S, We practise every day: Parents' attitudes towards early science learning and education among a sample of urban families in Ireland, Early Childhood Educational Resources, 2020

[14] Educators perceive boys as more confident than girls in all STEM subjects, STEM Equity Monitor, Department of Industry, Science and Resources, 20 July 2023

[15] Beilock, S. L., Gunderson, E. A., Ramirez, G., & Levine, S. C., Female teachers' math anxiety affects girls' math achievement, Proceedings of the National Academy of Sciences, 2010

[16] Early Childhood Workforce, Department of Education, Australian Government

3. Early STEM education is paramount to Australia's economic prosperity.

Australia faces a widening gap between the demand for STEM skills and the availability of qualified professionals to fill these roles. As Australia grapples with increasing critical skills shortages, particularly in emerging technology sectors, the importance of investing in early STEM education will only become more urgent.

By cultivating a strong STEM foundation in young children, particularly girls, Australia can effectively address these critical skills gaps, position itself competitively in the global economy, and fortify its workforce resilience, innovation capacity, and long-term economic prosperity. According to an economic study by Goldman Sachs, Australia's gross domestic product would increase by 11% if the gender gap in STEM learning was closed.[17]

Extensive academic research, including studies conducted by the Organisation for Economic Co-operation and Development (OECD), consistently underscores the critical role of early childhood education in shaping individuals' attitudes, aptitudes, and career trajectories in STEM fields.[18] Australia's concerning performance in international assessments like the Programme for International Student Assessment (PISA), particularly in science,[19] also highlights the need for targeted interventions to bolster STEM education outcomes from the earliest stages of learning.

The state of early STEM education in Australia

Both government and non-government interventions to improve students' participation and success in STEM have focused almost exclusively on tertiary, secondary, and (now increasingly) primary levels of education.[20] Unfortunately, **these efforts are on quicksand without investment in early childhood** as the first — and arguably most influential — stage of the STEM learning pipeline. It also means that children are not receiving a cohesive and consistent STEM teaching approach and learning environment as they make their pivotal transition from preschool into primary school.

The stark reality is that children in Australia have very limited and inequitable access to evidence-based early STEM education. This is because:

- Educators receive very little STEM teaching training as part of their TAFE and university pre-service qualifications.

[17] Womenomics in Australia – Some Progress, but More Potential, Goldman Sachs Economic Research, 26 November 2019
[18] Starting Strong Series, Organisation for Economic Co-operation and Development
[19] Cassidy, C., Australian students' Pisa scores still declining despite climb into OECD top 10, The Guardian, 5 December 2023
[20] STEM Education Initiatives Synthesis Report, Department of Education, Skills and Employment, 16 September 2021

- Educators are not supported to prioritise early STEM teaching professional development once they start working in the field.[21]

A growing equity gap in early STEM education

Little Scientists has a clear view of the extent of early STEM professional development in Australia. This is because educators who choose to develop their STEM teaching skills do so by participating in STEM professional development with Little Scientists, Australia's only dedicated provider of early STEM professional development.

In lieu of any external prioritisation of early STEM, the decision to prioritise STEM teaching skills is currently dependent on the **financial means** and **intrinsic motivation** of an individual educator or service. However, even as a not-for-profit, Little Scientists' STEM professional development is currently prohibitively expensive for most educators and services,[22] one of the country's lowest paid sectors.

Little Scientists can see this has led to a strong concentration of STEM professional development amongst educators and services in the most affluent suburbs of major cities. **A concerning equity gap in early STEM education is emerging**, marked by children's unequal (or non-existent) access to evidence-based, high-quality early STEM education.

A lack of investment in early STEM education directly contributes to:

- 1 in 3 primary school students in Australia are not meeting minimum numeracy expectations and 1 in 10 are so far behind that they need additional support.[23]
- Since PISA began recording results:
  - Australian students' scientific literacy has declined by 20 points, equivalent to a year of schooling;
  - Australian students' mathematics performance has declined 37 points, equivalent to almost two years of schooling;
  - Only 51% of students achieved the national proficient standard in maths and 58% for science.[24]

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[21] As noted in Figure 3.19 of the Productivity Commission's Draft Report, just 12% of all professional development undertaken by early childhood educators in Australia is focused on improving skills in specific curriculum areas, of which STEM is one of many.

[22] Little Scientists has 10 in-person STEM professional development workshop modules and each is 3.5 hours in length. A ticket to each workshop is $215 per person. Workshops have been developed by STEM and early childhood experts and incorporate empirical findings that draw on developmental psychology, learning research, and early childhood education pedagogy.

[23] Duffy, C., Young, E., One in three school students not meeting numeracy and literacy expectations, NAPLAN results show, ABC News, 23 August 2023

[24] PISA 2022 Results: Factsheets Australia, Organisation for Economic Co-operation and Development, 05 December 2023

- 49% of girls from low-socioeconomic communities in Australia don't think they are smart enough to study STEM.[25]
- Women only make up 37% of enrolments in university STEM courses, 17% of VET STEM enrolments, and 15% of all STEM-qualified jobs in Australia.[26]

Evidence & impact: Early STEM professional development

Early STEM professional development is important because it progresses educators' STEM teaching skills and knowledge beyond what they have learnt in their pre-service tertiary qualification. When educators attend high-quality and evidence-based STEM professional development, they return to their service with a rich repertoire of new STEM learning prompts and provocations that they can immediately start implementing for their children.

This is evident in analysis of Little Scientists' post-workshop attendee surveys, which found that **99% of educators felt confident** they could use their new STEM knowledge to facilitate quality STEM learning experiences.[27] Survey data also show that educators most value the **open-ended, hands-on exploratory components** of Little Scientists workshops, which are intentionally designed to allow educators to experience STEM learning as children do. This is a notably missing component of educators' typical lecture-style pre-service qualification.

From an inclusivity standpoint, high-quality and evidence-based STEM professional development trains educators to:

- Implement and embed developmentally appropriate STEM learning for children across all early childhood age groups, genders, abilities, and developmental levels.
- Overcome common misconceptions about the kinds of children who can engage meaningfully in early STEM education, for example: boys, older children, and "gifted" children.

[25] Australia's 2021 Youth in STEM survey by YouthInsight, STEM Equity Monitor, Department of Industry, Science, and Resouces, Australian Government

[26] The state of STEM gender equity in 2023, Department of Industry, Science, and Resources, Australian Government, 2023

[27] Analysis of post-workshop attendee feedback surveys, Little Scientists Australia

Participation in Little Scientists' professional development

Since 2016, Little Scientists has trained **8,815 educators** at in-person STEM workshops across Australia and a further **4,407 educators** at online STEM workshops. **376,872 children** is a conservative estimate of the number of children who have gained greater access (many for the first time) to high-quality and evidence-based early STEM learning as a result of their educators training with Little Scientists.

Little Scientists has also certified **198 services** across Australia as Little Scientist Houses, a unique program that assesses and recognises a service's commitment to evidence-based early STEM education on an ongoing basis, as well as develops STEM leadership within educator teams.

Local Network Partners (LNPs) are also a core part of Little Scientists' model and have extended to all states and territories (the ACT being the only exception). In this model, Little Scientists develops partnerships with values-aligned organisations that have the capacity and network to deliver workshops to educators in regions of the country beyond Little Scientists' reach. Our longest partnership has been with the Northern Territory Department of Education (NT DoE).

Case Study: Northern Territory Department of Education

As one of Little Scientists' most successful partnerships, the NT DoE provides a compelling case study for how governments across Australia can make a greater investment in early STEM education.

Since 2017, the NT DoE has delivered dozens of Little Scientists workshops in regional and remote communities such as Darwin, Alice Springs, Katherine, Tennant Creek, Yirrkala, and Nhulunbuy. Workshops have been well attended by First Nations educators and, where possible, trainers work with local First Nations Elders and educators to adapt workshop content for each local context. Because Little Scientists STEM workshops are hands-on and practical, they have proven to work well alongside local First Nations STEM knowledge.

The NT DoE subsidises Little Scientists workshops in the NT so that they are free and unlimited for all educators. This is a direct result of the NT Government making STEM education a key focus area of their early childhood education strategy.[28]

[28] STEM in the Territory Strategy 2018-2022, Northern Territory Government

Independent evaluation: Benefits of early STEM professional development

In 2020-22, Charles Sturt University (CSU) led a three-year independent evaluation of the impact of Little Scientists' STEM professional development (henceforth referred to as CSU Impact Study).[29]

The CSU Impact Study surveyed educator's personal rating regarding their knowledge in the field of STEM *prior* to participating in a Little Scientists workshop:

- 34-43% of educators believed they do **not** have sufficient **science** knowledge for their work.
- 12-19% of educators believed they do **not** have sufficient **mathematics** knowledge for their work.
- 57-65% of educators believed they do **not** have sufficient **engineering** knowledge for their work.
- 49-52% of educators believed they do **not** have sufficient **technology** knowledge for their work.

The CSU Impact Study also surveyed educator's personal rating regarding their knowledge of STEM teaching methods:

- 37% of educators believed they do **not** have sufficient knowledge of teaching methods for promoting early childhood **scientific** understanding.
- 19% of educators believed they do **not** have sufficient knowledge of teaching methods for promoting early childhood **mathematical** understanding.
- 49-52% of educators believed they do **not** have sufficient knowledge of teaching methods for promoting early childhood **technical** understanding.

The CSU Impact Study then evaluated the impact of a Little Scientists STEM professional development workshop on educators' early STEM teaching skills, knowledge, and confidence 21 days after attending.

- 93% of educators had successfully implemented new STEM teaching skills and knowledge into their work with children.
- 94% of educators felt more confident in their inquiry activities.
- 91% of educators felt they had broadly expanded their knowledge of science, technology, engineering, and mathematics.
- 97% were inspired to reflect on their educational work.

[29] MacDonald, A., Danaia, L., Hall, A., Lee, P., Final Report: Little Scientists Evaluation, Toyota Community Trust, Charles Sturt University, December 2022

This is supported by an earlier two-year study by Charles Sturt University (published in 2019) that evaluated Little Scientists professional development.[30] Findings showed:

Educators who participate in Little Scientists training:

- More regularly implement STEM experiences within their settings, reflecting a change in educational practices.
- Unanimously consider the workshop to be successful and beneficial, particularly in regard to developing confidence in implementing inquiry-based activities.
- Are more comfortable talking with young children about the scientific inquiry method, using scientific tools, and discussing ideas and issues of STEM learning.
- Can identify STEM-related learning with everyday materials in children's lives.
- Have developed their knowledge and skills to support children to explore STEM in their educational settings.
- Feel it is important for their room to have a STEM area that can be freely explored by children.
- Have overcome doubts and have realised that STEM can be simple and found in everyday activities.

Children who are taught by educators trained by Little Scientists:

- Show high levels of motivation and interest, as well as growing confidence, in STEM-related learning experiences.
- Are able to actively participate in STEM inquiry learning experiences that foster their STEM capabilities and positive dispositions.

[30] MacDonald, A., Danai, L., Sikder, S., Huser, C., Little Scientists Evaluation: Final Report, Charles Sturt University, March 2019